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New quantitative "Reading" of dielectric spectra of complex biological systems

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Abstract

Dielectric spectroscopy data from measurements on four insect species from 200 MHz to 20 GHz over a temperature range from 10 to 70°C are described through reduction of numerous micromotions to a few collective motions, recognition of a low-frequency dispersion through ratio presentation format, application of a self-consistent iteration procedure, a separation procedure for types of collective motions, and application of the eigen-coordinates method for calculation of seven fitting parameters. Use of such fitting parameters to describe the total system relaxation processes quantitatively should enable practical uses of dielectric spectroscopy for measuring desired qualities or characteristics of biological and other complex materials. This general approach based on the reduction procedure and the use of different formats, including the original fitting procedure, allows more precise determination of the corresponding fitting function and description of dielectric spectra of complex systems. The application of this general methodology can be considered as the basic goal and motivation for this paper. © 2006 IEEE.

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Keywords

Dielectric relaxation, Dielectric spectroscopy, Eigen-coordinates method, Insects, Permittivity, Reduced collective motions